**Ministry of Higher Education**
**And Scientific Research**
**University of Diyala**
**College of Engineering**
**Communication Engineering Department**

# Implementation of radio frequency identification for some application

A project

Submitted to the Department of Communications engineering University of Diyala-College of Engineering in Partial Fulfillment for the Requirement for Degree of Bachelor in Communication Engineering

By

**Farah Shihab Ahmed**

**Farah Mustafa Rasheed**

**Thoufiquar Abdalrazaq Hasan**

Supervised by

**Dr. Montadar Abas Taher**

**2016**

بسم الله الرحمن الرحيم

قالَ رَبِّ اشْرَحْ لِي صَدْري ﴿25﴾ وَيَسِّرْ لِي
أمْري ﴿26﴾ وَاحْلُلْ عُقْدَةً مِّن
لِّسَانِي ﴿27﴾ يَفْقَهُوا قَوْلِي ﴿28﴾

صدق الله العظيم

سورة طه

## SUPERVISORS CERTIFICATION

I certify that this project entitled “design and Implementation radio frequency identification simple application “ was prepared under my supervision at department of the Communications Engineering /College of Engineering university of diyala by **(Farah Shihab Ahmed, Farah Mustafa Rasheed, Thoufiquar Abdalrazaq Hasan)** as a partial fulfillment of the requirements for the degree of B.SC. In Communication Engineering.

**Signature:**

**Name:DR. Montadar Abas Taher**

**Title: doctor**

**Date: / /2016**

I certify that I have carefully read and corrected the final draft of this project for errors in punctuation, spelling and usage.

**Proofreader’s signature:**

**Date: / /2016**

In view of the ability recommendation, I forward this project for the debate by the examining committee.

**Signature:**

**Name: Montadar Abas Taher (Head of Dept.)**

**Title: doctor**

**2016**

## CERTIFICATION OF THE EXAMINATION COMMITTEE

We certify that we have read this project entitled "**design and Implementation radio frequency identification simple application**" and as examining committee examined the students (**Farah Shihab Ahmed, Farah Mustafa Rasheed, Thoufiquar Abdalrazaq Hasan**) in its contents and that in our opinion it meets the standards of a project for the degree of B. Sc. in Communication Engineering.

| | |
|---|---|
| Signature : | Signature: |
| Name : | Name: |
| Title : | Title: |
| Date: / /2016 | Date: / /2016 |
| (Member) | (Member) |

Signature :

Name :

Title:

Date: / /2016
(chairman )

Approved for Communication Engineering Department.

Signature:
Name: **Dr.Montadar Abas Taher**
(Head of the Department)

Title: Lecturer
Date: / / 2016

## DEDICATIONS

**For our Beloved Families. . . . . .**

**. . . . . . . Friends**

**. . . . . . . Classmates**

**. . . . . . . Lecturers**

# Acknowledgement

**In The Name Of Allah, theMost Beneficent, theMost Merciful**

**We wish to thank our family for theirunderstanding and support including our parents, siblings, our big family and our friends inside and outside university.We wish to express our deepest gratitude to our Advisor Dr. Montadar Abas Taher for his guidance and friendship during our study. Last but not least we want to thank the department of communication engineering for giving us the chance to work on as a fine project as this one.**

## TABLE OF CONTENTS

## LIST OF FIGURE

## List of abbreviations

| | |
|---|---|
| **RFID** | Radio frequency implementation device. |
| **IT** | Information technology. |
| **UHF** | Ultra high frequency. |
| **Usb** | Universal serial bus. |
| **Dsp** | Digital signal processor |
| **Psk** | Phase shift keying. |
| **Dsb_sc** | Double-sideband suppressed-carrier transmission. |
| **TPM** | Trusted Platform Module. |
| **AWGN** | Additive white Gaussian noise. |
| **NRZ** | Non return to zero . |
| **PSD** | Power spectral density . |
| **BPSK** | Binary phase shift keying |

# ABSTRACT

Radio Frequency Identification (RFID) technology is an emerging technology that allows for the electronic tagging and wireless identification of objects using RFID tags. Its application offers great potential for optimizing business processes by improving efficiency and by possible attractive cost savings. But its deployment also raises significant consumer privacy issues. RFID tags may reveal private consumer data without the subject's knowledge or consent. The challenge is to provide privacy protection without raising tag production and management cost. A new architecture for a trustworthy RFID reader has been proposed that can make RFID systems more privacy friendly. The RFID reader will contain a Trusted Platform Module (TPM). The TPM is a tamper-resistant hardware module designed to provide robust security capabilities like remote attestation and sealed storage. These capabilities combined with a newly designed reader software architecture can provide privacy policy compliant readers. The software architecture consists of a policy engine and an auditing agent for respectively enforcing and auditing the privacy policy of the trusted reader. The objective is to develop the proposed RFID architecture and to build an experimental implementation, which will demonstrate its potential use within a specific business case scenario.practical and simulation results show that the proposed schew can be a trusted method for library, storm ,or out similar based fashion .

# CHAPTER ONE

# INTRODUCTION

## 1.1 Background:

UHF (ultra high frequency) RFID got a boost in 1999, when the Uniform Code Council, EAN International, Procter & Gamble and Gillette put up funding to establish the Auto-ID Center at the Massachusetts Institute of Technology .Two professors there, David Brock and Sanjay Sarma, had been doing some research into the possibility of putting low-cost RFID tags on all products made to track them through the supply chain. Their idea was to put only a serial number on the tag to keep the price down (a simple microchip that stored very little information would be less expensive to produce than a more complex chip with more memory). Data associated with the serial number on the tag would be stored in a database that would be accessible over the Internet [1]**.**

## 1.2 What is RFID:

Radio frequency identification (RFID) is a form of wireless communication that uses radio waves to identify and track objects.An RFID system consists of three components: an antenna and transceiver (often combined into one reader) and a transponder (the tag). The antenna uses radio frequency waves to transmit a signal that activates the transponder. When activated, the tag transmits data back to the antenna. The data is used to notify a programmable logic controller that an action should occur as shown in fig (1.1) [8].

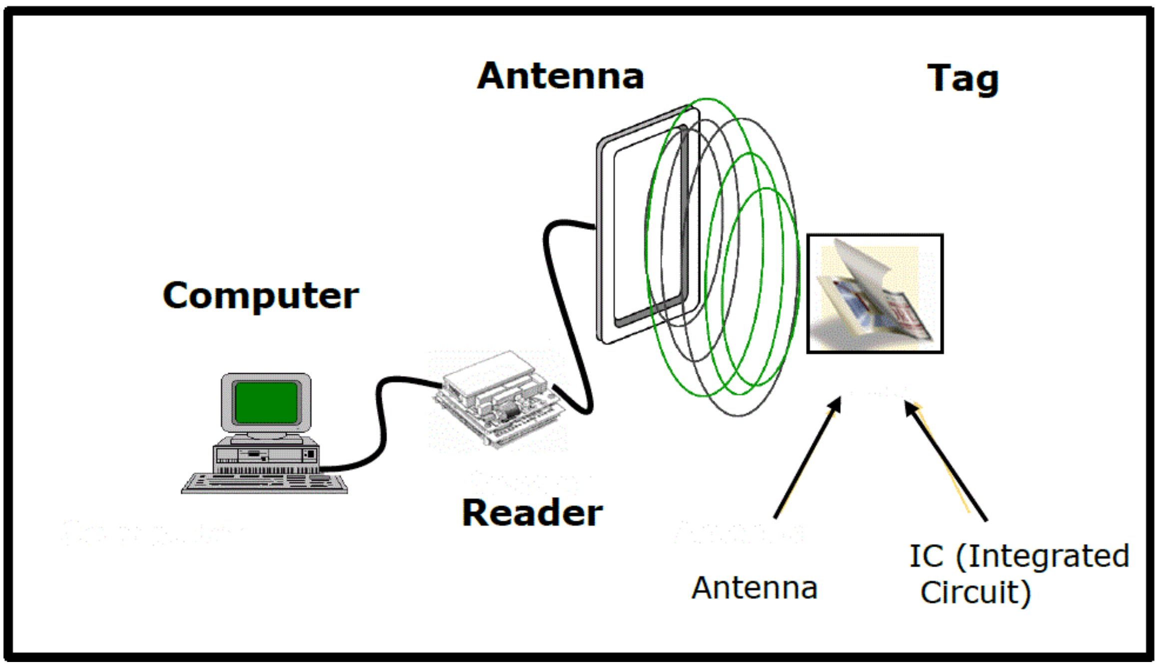



Figure (1.1): RFID construction element

## 1.3 Research Objectives:

The aim of this project is security (to provide a method to protect books, document, and other valuable objects in stores or libraries.

## 1.4 Outline of the project:

The project is basically divided into four chapters:

**Chapter 1**, this chapter deals with general background to the field of the research.

**Chapter 2**, describes the devices used in the project, it includes introduction of the RFID device,followed by an explanation of the devices that included into it such as (UHF reader, tags, host computer).

**Chapter 3**,present practical hardware and simulation designs.

**Chapter 4**presentsthe results of our design and simulation

**Chapter 5**This chapter puts the conclusion and the recommendationfor the future work.

# CHAPTER TWO

# THEORETICAL BACKGROUND
# OF THE
# RFID SYSTEM

## 2.1 Introduction:

This chapter presents an introduction to the basic devices in the UHf (ultra high frequency) READER, and contains the explanation of the nature of its work and its characteristic and how it is connected to computer by using the main part in this device that is USB (universal serial bus) cable. Also this chapter explains the programming language used to describe the device that is called C# (c sharp) and VC (visual C). UHFREADER is a high performance UHF RFID(ultra high frequency radio frequency implementation device) integrated reader. It is designed upon fully self-intellectual property. Based on proprietary efficient DSP algorithm, it supports fast tag read/write operation with high identification rate. It can be widely applied in many RFID application systems such as logistics, access control, anti-counterfeit and industrial production process control system [3].


Fig.(2.1)UHF RFID Reader UHFReader18

## 2.2Tags:

Two types of tags are adapted to RFID. There are two types of tags active and passive. in our work ,we adopted the passive one .

## 2.2 .1 Active tags:

Active tags have both a local power– the battery, and a conventional transmitter, so that theycan achieve the regular two-way radio communication. Because of the nature of battery, thesetags will have a limited lifetime. However, since usually the power consumption is very low,the power source of active tags can to live for up to 10 years.Data storage in transponders .The memory type of transponder can be any single type of ROM, RAM, or in combinationconstitute some of them. The memory form of transponder is dependent on the type of thetransponder. For instance, ROM version is the cheapest and smallest due to a lack ofrequirement of a power source and the extra circuits for writing. On the other hand, writablememory demands much more power, which is also the reason that writable transponders arealways active transponders [3], as shown in figure (2.1).


Figure (2.2) :active tag

### 2.2.2 Passive tags:

A passive tag is anRFID tag that does not contain a battery; the power is supplied by the reader. When radio waves from the reader are encountered by a passive RFID tag, the coiled antenna within the tag forms a magnetic field. The tag draws power from it, energizing the circuits in the tag. The tag then sends the information encoded in the tag's memory and The major disadvantages of a passive RFID tag are:

- The tag can be read only at very short distances, typically a few feet at most. This greatly limits the device for certain applications , It may not be possible to include sensors that can use electricity for power , and the tag remains readable for a very long time, even after the product to which the tag is attached has been sold and is no longer being tracked.

The advantages of passive tags are:

- The tag functions without a battery; these tags have a useful life of twenty years or more.
- The tag is typically much less expensive to manufacture
- The tag is much smaller (some tags are the size of a grain of rice). These tags have almost unlimited applications in consumer goods and other areas [6].Asshown in figure (2.2) and figure (2.3).

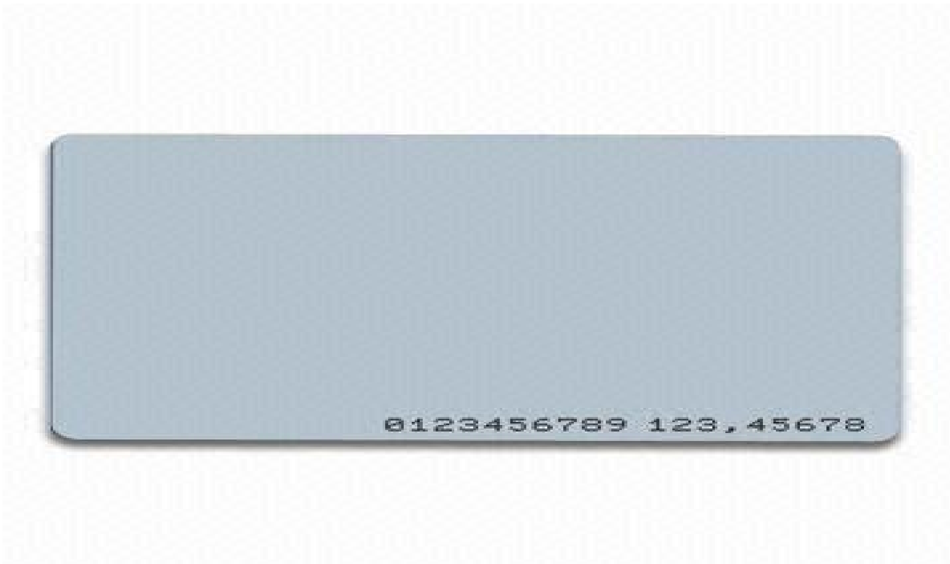



Figure (2.3): passive tag


Figure (2.4) passive tag

## 2.3: Host Computer or PC:

provides an interface between the RFID hardware and application based system, which is the “brain” of any RFID system. They are used to network multiple RFID interrogators together and to centrally process information[8]. The controller in any network is most often a PC or a workstation running database or application software, or a network of these machines .

## 2.4: The frequency used in RFID:

**1. Low (up to 148 kHz):** mainly used for access control and animal identification. It can be accessed up to 10cm away and is suitable for hostile environments, which can make it an expensive option. It offers a high penetration level around liquids and metals.

**2. High frequency (13.5 MHz):** the most common form of tag used in libraries utilises this frequency due to its relative low cost. It can be read up to 1m away and has a medium penetration of liquids, but does not work well with metal.

**3. Ultra high frequency (433MHz and beyond):** originally solely used in the supply chain management aspect of RFID, this frequency works well around metals but is not compatible with liquids (hence leading to problems of tags being shielded when simply being held by humans). It has a range of up to 100m if using an active tag or up to 10m if not

**4. Microwave (2.45 GHz):** mainly used in wi-fi and Bluetooth applications[4].

# CHAPTER THREE

# METHODOLOGY

## 3.1 Introduction:

This chapter contains the methodology Of RFID.It is show in the block diagram of figure (3.1).

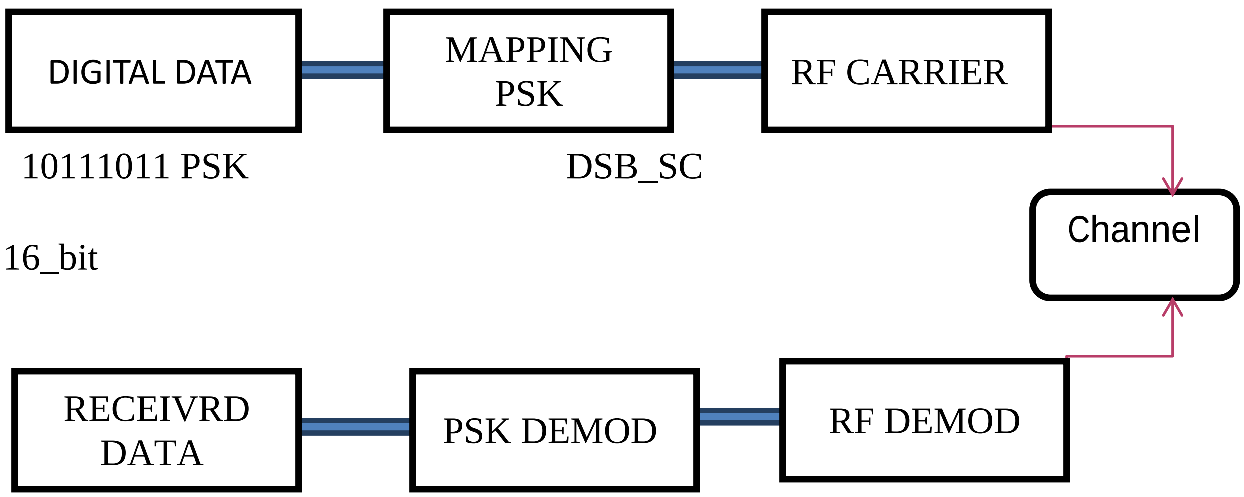



Figure (3.1):A simple block diagram for our RFID system

In the first part of the block diagram we generate the binary data such as 1011101100010111, which should be stored in the tag (16_bits), then the data interred to the mapping psk, in this part The simplest PSK technique is called binary phase-shift keying (BPSK). It uses two opposite signal phases (0 and 180 degrees). The digital signal is broken up time wise into individual bits (binary digits). The state of each bit is determined according to the state of the preceding bit. If the phase of the wave does not change, then the signal state stays the same (0 or 1).

If the phase of the wave changes by 180 degrees -- that is, if the phase reverses -- then the signal state changes (from 0 to 1, or from 1 to 0). Because there are two possible wave phases, BPSK is sometimes called bi phase modulation.For determining error-rates mathematically, some definitions will be needed:

$Q(x)$ Will give the probability that a single sample taken from a random process with zero-mean and unit-variance Gaussian probability density function will be greater or equal to $x$. It is a scaled form of the complementary Gaussian error function:

$$Q(x) = \frac{1}{\sqrt{2\pi}} \int_{\pi}^{\infty} e^{\frac{t^2}{2}}\ dt = \frac{1}{2}\ erfc\left(\frac{x}{\sqrt{2}}\right)\ , x \geq 0 \ldots\ldots \text{ Eq.(3.1)}$$

The error-rates quoted here are those in additive white Gaussian noise (AWGN). These error rates are lower than those computed in fading channels, hence, are a good theoretical benchmark to compare with Applications. InDouble-sideband, suppressed-carrier transmission (DSB-SC) is transmission in which frequencies produced by amplitude modulation (AM) are symmetrically spaced above and below the carrier frequency and the carrier level is reduced to the lowest practical level; In the DSB-SC modulation, unlike in AM, the wave carrier is not transmitted ; thus, much of the power is distributed between the sidebands, which implies an increase of the cover in DSB-SC, compared to AM, for the same power used .DSB-SC transmission is a special case of double-sideband reduced carrier transmission. It is used for radio data systems, such as the RFID system.DSB-SC is generated by a mixer. This consists of a message signal multiplied by a carrier signal. The mathematical representation of this process is shown in the equation (3.1), where the product-to-sum trigonometric identity is used.

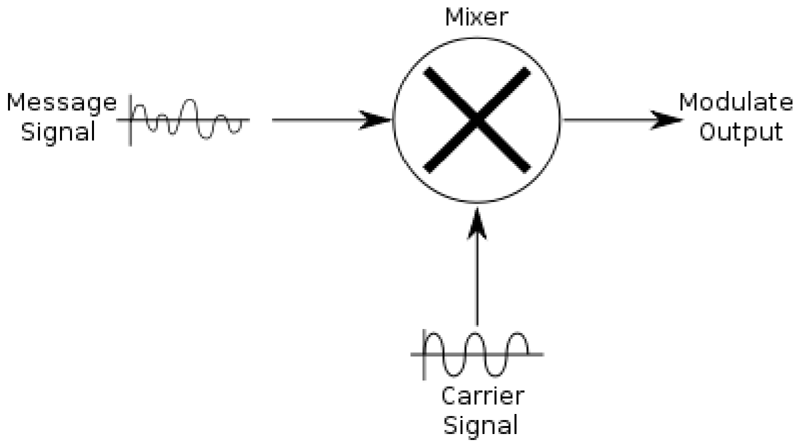



Figure (3.2): DSB_SC generation using a mixer

$$vm\cos(wmt) \times vc\cos(wct) = \frac{vmvc}{2}\left[\cos\big((wm + wc)t\big) + \cos\big((wm - wc)t\big)\right] \text{..e.q(3.2)}$$

Message carrier modulation signal

As indicated in figure (3.1) , after the modulation process , using the DSB-SC technique ,the resultant signal will be passed through an AWGN channel. Thus, the signal will be captured by the receiver , where the RF-demodulation will be accomplished , to get the digitally encoded signal. Hence , the data will be decoded to get the digital code of the tag [4].

# CHAPTER FOUR

# THE RESULTs

## 4.1 Simulation results and discussion:

This part of the project, shows the results of the simulation for the radio frequency identification (RFID) transmission system. Figure (4.1) shows 16 binary digital that may be stored in a passive tag. These 16-bit were line-coded using the polar non-return to zero (polar NRZ) format as shown infigure(4.2)

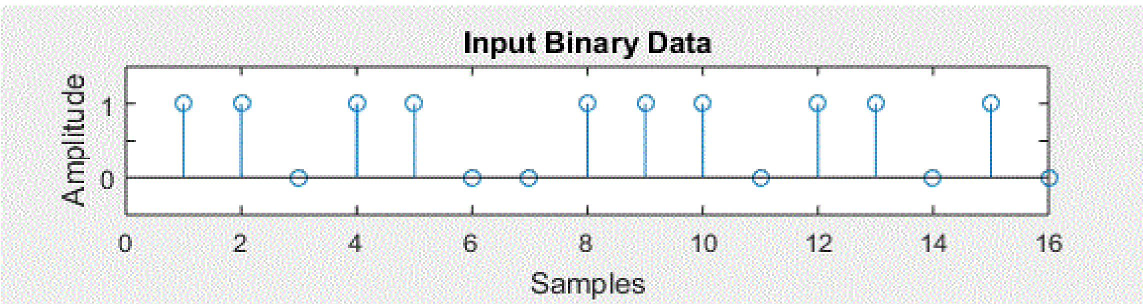



Figure (4.1): sixteen binary digital of a passive tag.

Upon entering this data into basic turn into a digital square wave as shown in Figure:

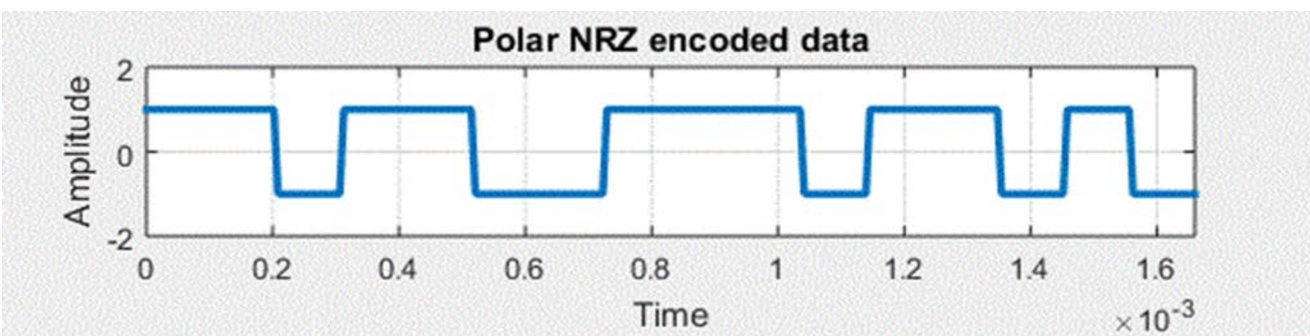



Figure (4.2): polar NRZ line coding for the data in figure 4.1

As shown in figure (3.1) in chapter 3, the next process will be the BPSK mapping, this BPSK mapping can be visualized in figure (4.3) .

It can be seen that binary 1 did not change the phase of the sinusoidal carrier, while binary 0, the sinusoidal carrier got 180 phase shift.

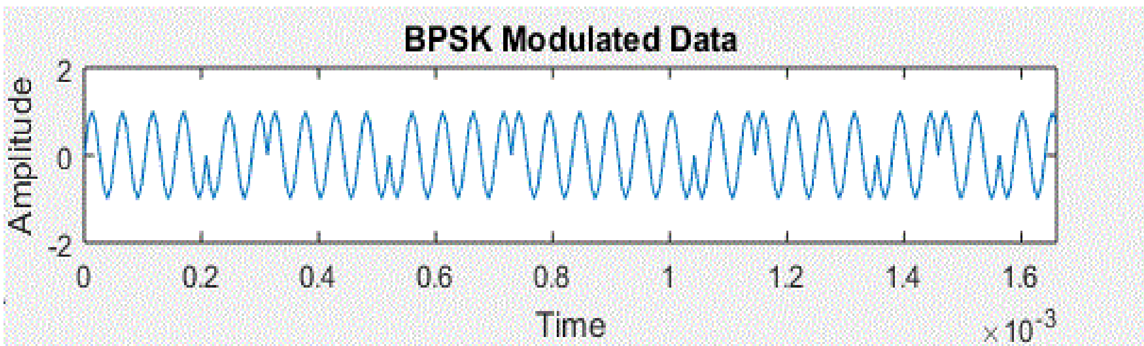



Figure (4.3): BPSK base band modulation.

Then the wave included and sent by RF Carrier to receive full and turn from PSD as shown in Figure: -

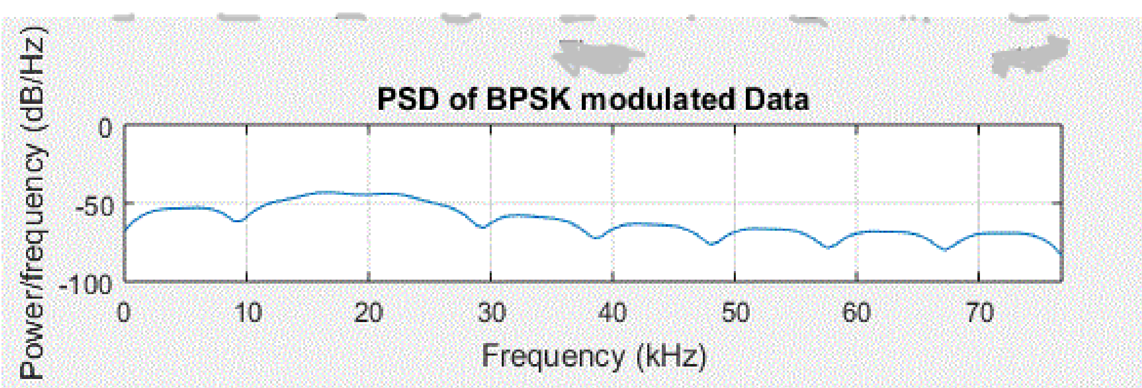
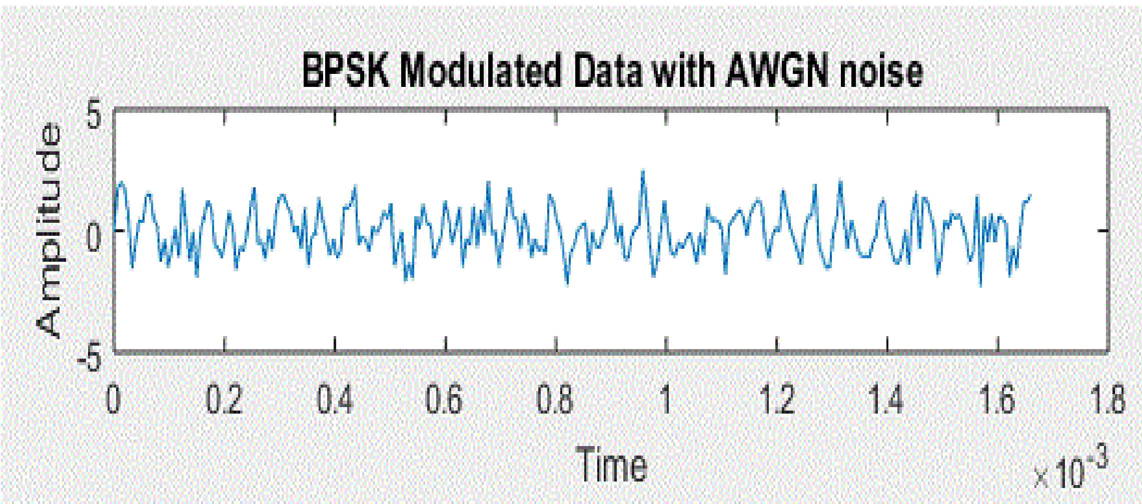



Figure (4.4): power spectral density of the BPSK signal.

However the power spectral density (PSD) of the BPSK signal can be seen in figure (4.4) .On the other hand, the RF-modulated signal can seen in figure (4.5). The last figure shows the RF-modulated signal with the AWGN channel. It is good practice to mention that the RF-carrier in our RFID simulation was 19.2 kHz, where the data rate was 9600 bits per seconds. Moreover, the AWGN variance is 0.5.

Figure (4.5): DSB_SC modulated signal.




## 4.2 Practical Results and Discussion

In this part, we have to show the results. That obtained from our RFID system. Figure (4.6) shows the binary data stored in the first tag, which was purchased with the interrogator (reader) of the RFID system. Whilefigures (4.7) depict the stored data of the second tag.In fact, these data were captured using an oscilloscope in the Lab of the student's projects. It is shown that both tags have different information than our simulation; however, this is not a matter, where we have designed our MATLAB simulation to transmit or receive any tag's data.

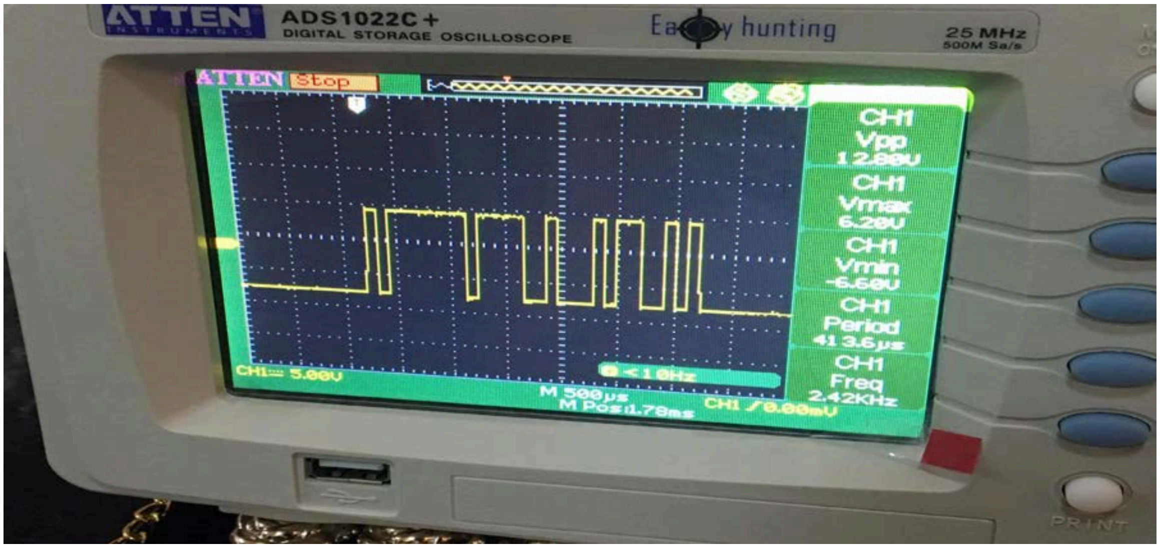



Figure (4.6):Data stored on first tag.

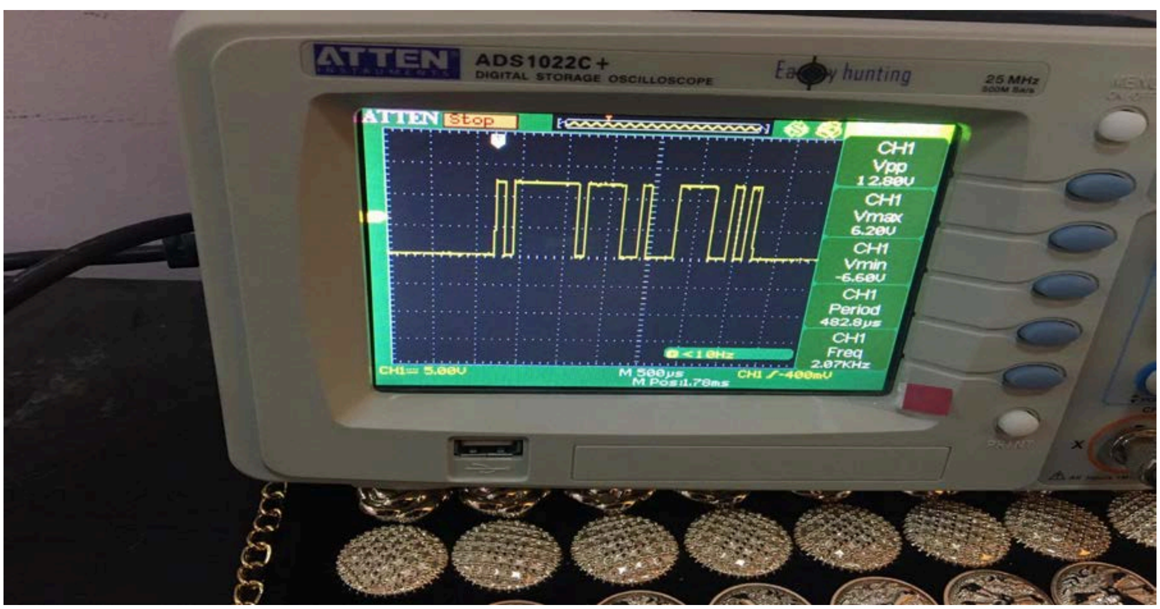



Figure (4.7):DSP_SC modulated signal

# CHAPTER 5

# CONCLUSION AND

# The FUTURE WORK

## 5-1 Conclusions:

This project provides a defined radio frequency applications, which includes (reader, tag, antenna, computer) where the transmission of data from the tag to the antenna via radio waves, which provides radio-frequency and then to the reader (known frequency device) and are presented in the calculator where is linked to the calculator to your reader through the cable connecting the goal is to achieve protection of the mark in as the application is to be inside a book or clothes or other applications and to clarify so be bandwidths to be inside the SIM mark on a spectrum analyzer wave-shaped square the account for numeric order (1,0), which reflects the inventory figure within the mark.

## 5-2 Suggestions for thefuture work:

RFID may not be a new concept today but it certainly makes our work easier when it comes to management. Today we see RFID has almost taken over the barcode system and has its application in many fields like inventory control, retailing, payment system, security system etc. Many of the consumer applications and benefits of RFID are still several years away which would certainly find new and innovative ways**.**

## References:

1. Copyright 2003 John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England.

2.Copyright © 2006 O'Reilly Media, Inc. All rights reserved. Printed in the United States of America. Published by O'Reilly Media, Inc. 1005 Gravenstein Highway North, Sebastopol, CA 95472..

3.Copyright © 2005 Sun Microsystems, Inc. All rights reserved. Printed in the United States of America. This publication is protected by copyright, and permission must be obtained from the publisher prior to any prohibited reproduction, storage in a retrieval system, or transmission in any form or by any means, electronic, mechanical, photocopying, recording, or likewise..

4.© 2008 by Taylor & Francis Group, LLC CRC Press is an imprint of Taylor & Francis Group, an Informa business No claim to original U.S. Government works Printed in the United States of America on acid-free paper 10 9 8 7 6 5 4 3 2 1.

5. Copyright © 2007 by Technology Research Corporation. All rights reserved. Published by John Wiley & Sons, Inc., Hoboken, New Jersey. Published simultaneously in Canada.

6. Motamedi A, Hammad A (2009) Lifecycle management of facilities components using radiofrequency identification and building information model, Journal of Information Technology in Construction(ITcon), Vol. 14, Special Issue Next Generation Construction IT: Technology Foresight, Future Studies,Roadmapping , and Scenario Planning, pg. 238-262,

7. http://www.aimglobal.org/page/technologies

8. http://www.rfidjournal.com/articles/view?1339

9.http://internetofthingsagenda.techtarget.com/definition/RFID-radio-frequency-identification

# الخلاصة

يقدمهذاالمشروعاحدى تطبيقات الترددات الراديوية المعرفة والذي يتضمن (القارئ، العلامة، الهوائي ،الكومبيوتر )حيث يتم انتقال البيانات من العلامة الى الهوائيعن طريق الموجات الراديوية والتي توفر التردد الراديوي من ثم الى القارئ(جهاز الترددات المعروفة) ويتم عرض ذلك في الحاسبة حيث يتم ربط الحاسبة بجهاز القارئ عن طريق كيبل توصيل والهدف هو تحقيق الحماية للعلامة الموجودة حسب التطبيق كأن يكون داخل كتاب او ملابس او غيرها من التطبيقات وتوضيح الى ذلك يكون عرض الموجات الي تكون داخل شريحه العلامة على جهاز محلل الطيف على شكل موجة مربعه تمثل عن ترتيب رقمي ( 1,0) والتي تعبر عن الرقم المخزون داخل العلامة.

**وزارةالتعليمالعاليوالبحثالعلمي**

**جامعةديالى**

**كليةالهندسة**

**قسم هندسة الاتصالات**

# الترددات الراديوية المعرفة

مشروع مقدمإلىقسمهندسة الاتصالات

في جامعة ديالى – كلية الهندسةكجزء منمتطلبات نيلدرجةالبكالوريوس في هندسة الاتصالات

**منقبل**

**فرح شهاب احمد ، فرح مصطفى رشيد**

**ذوالفقار عبد الرزاق**

**أشراف**

**د. منتظر عباس طاهر**

**2016**